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Proton-exchange membranes composed of slightly sulfonated poly(ether ketone ketone) and highly sulfonated crosslinked polystyrene particles

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Abstract

Proton-exchange membranes composed of sulfonated poly(ether ketone ketone) (SPEKK) and sulfonated crosslinked polystyrene (SXLPS) particles were made by solution casting using *N*-methyl pyrrolidone (NMP). The proton conductivity of SPEKK membranes with relatively low ion-exchange capacity (IEC = 0.8–1.3 meq/g) was greatly enhanced by the addition of the SXLPS particles (IEC = 5.2 meq/g). The proton conductivity exhibited a sigmoidal dependence on the SXLPS particle concentration, and values of 0.04–0.07 S/cm were achieved for SXLPS weight fractions >0.4. The equilibrium water sorptions of the composite membranes increased proportionately with increasing SXLPS concentration. However, for a comparable membrane IEC, the composite membranes absorbed considerably less water than pure SPEKK when the overall IEC exceeded 1.5 meq/g. For particle weight fractions >0.2, the dispersion of the particles was fairly uniform, but for lower concentrations, the particles settled and were concentrated on just one side of the solution-cast membrane. This asymmetric structure could have merit for some applications, and its properties are under investigation.

Keywords: Proton-exchange membranes; Sulfonated poly(ether ketone ketone); Sulfonated crosslinked polystyrene; Proton conductivity; Composites